Schroeder Creek Road

Complaint Investigation 020438

FPB/IRC/94

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The Investigation

This complaint is about the Schroeder Creek forest access road built by Kalesnikoff Lumber Company Limited (the licensee) in the Kootenay Lakes Forest District. Valhalla Wilderness Society (the complainant) asked the Board to investigate six landslides, or failures, that occurred along the road, including planning, general road building practices, and the Ministry of Forests' enforcement of the *Forest Practices Code of British Columbia Act* and its regulations (the Code) for the road.

The Board decided to investigate whether the licensee met the Code's requirements for planning, road building and enforcement for only the sections of the road that include two landslides, referred to in this report as "landslide 1" and "landslide 2." The ministry's determinations for the four other failures are being reviewed through the administrative review and appeal process under the Forest Practices Code. The Board is involved in some of those review and appeal actions. In order to avoid prejudicing this investigation, and the review and appeal process, the panel for this report was not involved in the review and appeal work and did not consider those other landslides.

The investigation included interviews with participants, a field review of the sites of landslides 1 and 2, a review of files, and detailed consideration of comments made by participants on earlier drafts of this report.

Background

The Schroeder Creek watershed is 15 kilometres north of Kaslo, BC. Schroeder Creek is a domestic watershed with two licensed water users. Kokanee and bull trout spawn in the creek near its outlet into Kootenay Lake.

In 1985, firefighters built access trails into the watershed to combat a large wildfire, the Lost Ledge fire. The watershed has otherwise remained undeveloped until recently because of its challenging terrain. It has slopes averaging 60 percent with many avalanche chutes, debris torrent gullies and landslide scars.

In the late 1990's, the licensee assessed the feasibility of logging in the watershed. It decided to seek approval for development of the watershed, selecting a route that required building eight kilometres of new road. A terrain assessor mapped terrain stability and completed a terrain stability field assessment for the new road. The terrain assessor recommended road building practices for most of the road. A professional engineer designed some sections. For some sections of road located on steep slopes, the engineer prescribed constructing oversteepened stacked rock fills as an alternative to costly full-bench construction. The engineer's designs and prescriptions and the terrain assessor's recommendations were incorporated into a road layout

and design, which the district manager of the Kootenay Lakes Forest District approved on August 1, 2000. Road construction began almost immediately.

On August 15, 2000, the ground slid at or near an old fire access trail, located downslope of road stations 0+850 to 0+900 (landslide 1). Landslide 1 occurred before the licensee was finished building that section of road, while the road contractor was blasting a rock face on the road right-of-way. The landslide shifted 65 to 100 cubic metres of ground further down the slope. Some logs, rock and soil from the slide reached the creek 400 metres below the road and temporarily obstructed it. The resulting sedimentation of the creek made a local resident's water undrinkable for two days. The licensee provided the resident with drinking water, informed the district manager of the slide, moved road construction material to an alternate site and implemented a mitigation plan.

On May 11, 2001, the district manager found that the licensee, its contractors and its hired qualified registered professionals should have suspected that the old fire access trail downslope of the road might not be structurally sound. He determined that the licensee should have reasonably known that building the road would result in landslide 1, contravening section 45(3) of the Act. He required the licensee to bear the remediation and reconstruction costs, but did not assess any additional penalties. The licensee appealed the determination to a review panel, which upheld the determination but allowed the licensee to recover incremental costs of constructing a full-bench road for that section. The licensee did not appeal the review panel's decision to the Forest Appeals Commission.

On April 10, 2001, the road building contractor discovered another landslide on a completed section of road between stations 0+991 to 1+047 metres (landslide 2). Landslide 2 displaced 2,400 cubic metres of a stacked rock fill. Most of the rock fill settled in a wide, less steep area below the road. Some of the fill spilled over into a natural slide chute, with a few boulders reaching Schroeder Creek. The licensee informed the district manager of the landslide and implemented a remediation plan. Ministry staff investigated the landslide and decided against recommending any formal enforcement action.

Issues Investigated

The Code includes requirements that a licensee must follow when planning and building a road. It provides the district manager with authority to enforce those requirements. Together, the planning, building and enforcement provisions are intended to reduce the likelihood of forest practices causing a landslide and damaging forest resources. The Board addressed the complainant's concerns by investigating the following issues for the sections of road that include landslides 1 and 2:

1. Did planning meet the requirements of the Code?
2. Did road building meet the requirements of the Code?
3. Was enforcement of the Code appropriate?

The Board considered the requirements of the Code at the time the road was planned and built.

Discussion

1. Did planning meet the requirements of the Code?

For some terrain conditions, the Code requires a licensee to prepare a terrain stability field assessment before designing and laying out the road. Where a road crosses terrain with a moderate to high likelihood of landslides, as determined by a terrain stability field assessment, it also requires a licensee to incorporate measures to maintain slope stability into a road layout and design. The Board investigated whether the licensee met those planning requirements.

Adequacy of the terrain stability field assessment

The licensee completed terrain stability mapping, which indicated that the areas where landslides 1 and 2 later occurred had a moderate to high likelihood of landslides. That compelled the licensee to undertake a terrain stability field assessment (previously section 4(5) of the *Forest Road Regulation* (FRR)). The licensee had the terrain assessor complete a terrain stability field assessment for the entire length of road, thereby meeting that requirement. However, the complainant believes that the terrain stability field assessment underestimated the likelihood of landslides and therefore asked the Board to assess its accuracy.

The terrain assessor classified all or parts of both areas where the landslides occurred as "potentially unstable." Ground conditions have since changed due to road construction, the landslides and landslide remediation. Current conditions are not a reliable indicator of conditions at the time the terrain assessment was done, so assessing the accuracy of the terrain assessor's risk ratings is now difficult. In any event, a higher risk rating would invoke the same management requirements under the Code and would not necessarily have changed the licensee's management approach. For those reasons, the Board did not assess the accuracy of the terrain stability ratings. Instead, the Board evaluated the thoroughness of the assessment relative to the procedure in the *Mapping and Assessing Terrain Stability Guidebook - 1999* (the guidebook).

The guidebook is based on the knowledge and advice of experts. Section 1 of the FRR states that an assessment must follow the procedures set out in the guidebook. However, the guidebook requires each professional to exercise his or her professional judgement in selecting the field assessment methodology that best suits the site conditions, the goals of the assignment and the client's needs. Therefore, the guidebook gives a terrain assessor discretion to vary from its recommended approach. The Board considered the terrain assessor's exercise of discretion in the case of the Schroeder Creek terrain stability field assessment.

The guidebook states that it is not sufficient to describe areas using the 5-class labels intended for terrain stability mapping. Instead, it recommends a "high," "moderate" and "low" classification system, which has management implications under the Code. The Schroeder Creek assessment used the 5-class labels that the guidebook discourages, but also provided a key for interpreting results in terms of the alternate classification system. The Board considers

that the choice of classification used for Schroeder Creek is not significant since it did not affect the management approach for the area.

The guidebook also states that an assessment should cover the potential on-site and off-site effects of harvesting and road construction, including possible down-slope consequences of road construction activity. An assessment should address sidecast limitations for roads and identify sections for "endhauling." An assessment should also describe the presence, distribution, magnitude and effects of natural landslide activity. The guidebook states that results and recommendations should be clearly stated in plain language so that forestry personnel fully understand the planning/management implications and what needs to be done.

The Schroeder Creek assessment provided some limited information on downslope consequences and on-site and off-site effects of harvesting and road construction, but did not state results and recommendations clearly. It mapped the location of natural landslides (including a natural landside in the area below where landslide 1 occurred), but did not describe the magnitude or effects. It identified sections where engineering was required, but for other sections of road, did not describe sidecast limitations or identify sections for endhauling. The assessment therefore did not provide all of the information recommended by the guidebook to guide forestry development. The Board believes that the challenging terrain conditions warranted the terrain assessor providing more detailed information and clearer recommendations, as described as standard practice in the guidebook, or a rationale for not doing so.

Some participants in this complaint investigation questioned whether the thoroughness of the terrain stability field assessment reflected the terrain assessor's qualifications to do such work. The previous section 4(9) of the FRR required that a "qualified registered professional" prepare the terrain stability field assessment. The licensee was responsible for ensuring that the assessor was a qualified registered professional (previously section 6(2) of the FRR).

To be a qualified registered professional under the Code, a person has to meet two requirements. The first requirement is that the person be a member of, or licensed by, a professional organization with legislated authority to regulate its members or licensees in performing the activity (previously in section 1 of the FRR). In this case, the terrain assessor is a member of the British Columbia Institute of Agrology (BCIA), which was subject to the *Agrologists Act* (since replaced by a revised *Agrologists Act*). The Board notes it is a long-standing practice for some BCIA members to complete TSFAs, and the BCIA interprets that it can regulate its members doing this function. The Board therefore accepts that the terrain assessor belongs to an appropriate professional organization.

The second requirement for a qualified registered professional is appropriate education and experience to carry out an activity. In this case, the terrain assessor has a university degree in geology and soil science. He has completed most university courses recommended for terrain assessors by a joint board of professional associations. While Schroeder Creek conditions were more challenging than the terrain assessor had previously experienced, he had completed

terrain stability field assessments and mapping for other clients in the area for over 20 years. For those reasons, the Board finds that the terrain assessor had appropriate education and experience to complete the terrain stability field assessment. The terrain assessor thus met both requirements for a qualified registered professional and was qualified under the Code to prepare the terrain stability field assessment. The licensee was familiar with the terrain assessor's professional affiliation, education and experience, meeting the requirement for the licensee to ensure that the terrain assessor was qualified.

Measures to maintain slope stability

The Code requires that a road layout and design include measures to maintain slope stability where the road crosses areas determined by a terrain stability field assessment to have a moderate or high likelihood of landslides (previously section 8(1)(g) of the FRR). In this case, the terrain stability field assessment classified the area of landslide 1 and part of the area of landslide 2 as having a moderate likelihood of landslides, thereby requiring measures to maintain slope stability. The road layout and design included measures for those areas—aligning and placing large rock with an excavator to construct oversteepened fills in the areas of landslide 1 and 2. Licensee staff certified that the road layout and design included the slope stability measures. The road layout and design therefore met requirements to include measures to maintain slope stability.

Other requirements to maintain slope stability applied if a road layout and design was submitted after July 1, 2000. The Board finds that the licensee submitted a substantially complete road layout and design prior to that date, so those other requirements did not apply.

In summary, the licensee met the Code's planning requirements to include measures to maintain stability and to complete a terrain stability field assessment. However, the challenging terrain conditions warranted providing more detailed information in the terrain stability field assessment, as recommended by the guidebook, or a rationale for not doing so.

2. Did road building meet the requirements of the Code?

The complainant believes that the licensee contributed to the landslides 1 and 2 by:

- not following the approved road layout and design;
- using sub-standard construction techniques, as demonstrated by logs in the road sub-grade in the area of landslide 2; and
- building the road despite evidence of terrain instability.

The Board investigated whether road building met the Code's requirements to follow the approved road layout and design, remove organic material from the roadbed and prohibit road building where it may cause a landslide.

Following the approved road layout and design

A licensee must ensure that road construction generally conforms to the approved road layout and design (previously section 12(1)(b) of the FRR). The Schroeder Creek road layout and design required the licensee to ensure that a qualified registered professional certify that measures to address areas of moderate or high likelihood of landslides have been carried out (previously section 12(1)(c) of the FRR). The Board interprets that construction generally conforms with the design if changes from the design are minor, the final road is as stable as the original design, and the construction results in a similar or lower level of risk to forest resources.

For the area of landslide 1, the landslide occurred before construction was completed or certified as conforming to the road layout and design. At the time of the failure, the licensee had constructed a temporary berm, not shown in the road design, on a section of the fire access trail located downslope from the road. However, the road design shows that section of the fire access trail as the location for a stacked rock fill. The Board therefore considers that loading from the temporary berm did not increase the risk of instability from that of the approved design. The Board found no other evidence that the road construction varied from the approved road layout and design. The Board therefore finds that the licensee met the requirements to follow the approved road layout and design for the area of landslide 1.

For the area of landslide 2, the licensee placed 120 cubic metres, or 16 percent, more stacked rock fill from station 0+985 to 1+020 than was approved. That could indicate that the licensee built a less stable road than was specified in the approved design. However, the 16 percent variance falls within the bounds of normal road building practice. The road approximated the calculated cut and fills of the road layout and design, resulting in a partial bench road as approved in the design. The engineer certified that the stacked rock fill was built as he had recommended. The Board finds that the licensee met the requirements to follow the approved road layout and design for the area of landslide 2.

Organic material in the roadbed

Organic material in a road can destabilize the road as it decomposes. A licensee must therefore remove embedded logs, stumps and roots from the road prism (i.e. the area of ground containing the road surface, cut slope and fill slope). The Code provides for exceptions, but those exceptions did not apply to the circumstances of this investigation.

Landslide 2 revealed two logs that the licensee had not removed from the road subgrade, contrary to the Code. The logs were less than 30 centimeters in diameter and no other organic material was observed over the 50-metre length of the failure. The licensee did not comply with the Code's requirement to remove organic material from the roadbed, but that non-compliance was, in the Board's view, not significant given the small amount of organic material. The organic matter did not contribute to the occurrence of the landslide, since it did not have time to decompose.

Prohibited road building

The Code prohibits a person from carrying out a forest practice in some circumstances:

> "A person must not carry out a forest practice if he or she knows or should reasonably know that, due to weather conditions or site factors, the carrying out of the forest practice may result, directly or indirectly, in (a) slumping or sliding of land..." (section 45(3) of the Act)

Road building is a forest practice.

Submissions to the Board indicated that the participants have different interpretations of section 45(3). The Board therefore considered how to interpret the provision to analyze this complaint and also to provide guidance to forest practitioners.

The Board considered what is meant by "site factors." The Board's view is that a site factor is an underlying cause of instability, such as unstable bedrock geology. A site factor can be independent of the event that initiates or triggers the landslide. For example, when a severe storm increases seepage, which in turn causes weak bedrock to fail, site factors would be seepage and unstable bedrock geology, but not the event that triggered the failure, i.e., the storm.

Next, the Board considered section 45(3) in the context of other related subsections, paraphrased for these circumstances, as follows:

- Subsection (1) sets the general prohibition: a person must not carry out road construction that results in damage to the environment.
- Subsection (2) makes an exception. A person is allowed to construct a road that results in damage to the environment if doing so complies with the rest of the Act and regulations, and has been authorized in an approved plan, a legislated exemption, or a road permit. This allows government to evaluate risk and, with an approval, authorize anticipated risk that might result in damage to the environment.
- Subsection (3) is then intended to deal with site factors that were not implicitly planned, anticipated or approved in the process of subsection (2). Even if the road construction were approved in plans or permits, a person must not carry out such construction if he or she should reasonably have known that site factors existed that created conditions such that might cause a slump or landslide.

From the phrase "knows or should reasonably know," it follows that only those site factors that are detectible or foreseeable are relevant to section 45(3). The Board's view is that subsection (3) is intended to deal only with those site factors indicating potential instability that were not implicitly planned, anticipated or approved that are, or should have been, detected during planning or road construction.

A section 45(3) contravention requires that the forest practitioner reasonably know that the site factors "may" directly or indirectly result in slumping or sliding of land when the licensee is undertaking a forest practice. While a number of site factors may conceivably create conditions such that a forest practice causes a landslide, the Board's view is that section 45(3) does not prohibit a forest practice where the likelihood of a landslide is remote. Conversely, certainty of a slump or landslide occurring is not required for section 45(3) to apply. Rather, the test falls somewhere between those two extremes: would a qualified and experienced practitioner expect that the site factors are likely to create conditions that would result in the forest practice causing a landslide? If so, the person is prohibited from undertaking the forest practice until that likelihood is eliminated through means such as additional assessments or modification of the forest practice.

The Board thus assessed whether the licensee's road building in the area of landslides 1 and 2 complied with section 45(3) by: i) identifying the site factors causing instability; ii) determining whether those site factors were explicitly planned, anticipated or approved; iii) assessing whether those site factors were detectable or foreseeable; and, if so, iv) determining whether site factors not previously planned for, anticipated or approved were likely to create conditions that would result in a landslide when building the road.

Landslide 1

The complainant agreed with the district manager's determination, upheld by the review panel, that the licensee should have reasonably known that the road building may result in a landslide. The licensee and its contractors disagreed with the review panel's decision and asked the Board to investigate. The Board agreed to investigate this with some reservations because the licensee could have appealed the review decision to the Forest Appeals Commission but did not do so. The timeframe for the licensee to appeal to the Forest Appeals Commission has now passed.

Statements originally provided by the terrain assessor, the road engineer and road building contractors suggested that the landslide was triggered by the loading of the temporary berm on the upper fire access trail (the section of the trail above a switchback in the trail) or by rock striking and destabilizing the lower fire access trail (the section of the trail below the switchback). The terrain assessor indicated that the lower section of the fire trail gave way where a creek and a bedrock spring had saturated the slope. Their statements suggest that the site factors causing instability included:

- the condition of the upper fire access trail;
- a previously undetected bedrock spring located above the upper fire access trail and within the road prism; and
- the condition of the lower fire access trail.

A later report, prepared by a geotechnical engineer on behalf of the licensee, provided another analysis of the contributing factors that gave rise to the landslide. The geotechnical engineer's opinion was that the slide was triggered by rock blasting on the road right-of-way, which increased groundwater flows from a bedrock spring. That resulted in an increase in pore water pressure at the location of logs and plastic sheeting buried in the slope between the upper and lower fire trails. He suspected that the logs and plastic sheeting had originally been placed to create a sump and flume to collect water for firefighting. He stated that the construction of the plastic lined flume and sump on, and downslope of, the upper fire trail and the impact of the lower fire trail cutslope were likely significant factors in the landslide. He found that the logs contained in the upper fire trail were sound and that the upper trail was largely intact after the landslide. He therefore concluded that the upper fire trail probably helped to stabilize the area, and that adding the berm did not trigger the landslide.

The Board considers that the detailed geotechnical report provides a plausible hypothesis on the potential triggers of the landslide (i.e. rock blasting and the increase in pore water pressure) and site factors causing instability (i.e. the buried sump, the lower fire trail and the bedrock spring). The Board accepts the geotechnical engineer's hypothesis that the upper fire trail was not a site factor causing instability, and finds that the site factors causing instability were limited to the buried sump, the lower fire trail and the bedrock spring.

The Board considered whether those three site factors were implicitly planned, anticipated or approved. The terrain assessor walked the lower fire trail during the terrain assessment. The terrain assessor and licensee were aware of the lower fire trail and decided that it presented a low risk of contributing to instability, given its location 48 metres away from the road surface. The location of the lower section of the fire access trail was identified on a map included in the TSFA report. The Board's view is that the lower section of the fire access trail was implicitly planned for by the licensee. As section 45(3) relates to only site factors that were not previously identified and planned for, the lower fire access trail is not a site factor for that section.

In contrast, the buried sump was not identified or planned for prior to road construction. It therefore remains a potential site factor under section 45(3). Similarly, the spring location was not identified, planned or approved prior to road building.

The Board next considered whether the unplanned site factors causing instability – the sump and the spring – were also detectible or foreseeable. The sump was buried three metres below the surface. Terrain assessments typically do not include excavating to examine sub-surface conditions at that depth. There were no visible indicators of the sump's presence. The Board found nothing to indicate that the licensee did or should have detected the sump during road building. As section 45(3) relates to only detectible site factors, the failure to identify and address the sump prior to the landslide does not support a finding of non-compliance with section 45(3).

The Board found contradictory information regarding whether water flowing from the spring was detectable. The licensee indicated that it was aware of the presence of dampness in the area

above where the failure occurred, but that there was no significant waterflow. Photographs taken around the time of the failure do not show any water flow at the location of the spring, after the creek further up the access trail had been restored to its original channel. In the Board's view, those photographs are inconclusive regarding the extent of water flow, since spoil rock on the upper fire trail would have concealed any water flow when those photographs were taken. An equipment operator provided an evidence statement to MOF indicating that he had earlier placed material on either side of the spring's water flow to ensure that it continued flowing across the old fire access trail. Shortly after the landslide, the terrain assessor agreed with MOF staff that when the diverted stream was returned to its original channel, the existence of additional significant water should have been observed, noted and dealt with, but was not because the chain of communication was inadequate to support the road builders.

In the Board's view, the statements by the equipment operator and the terrain assessor indicate that there was significant water flow visible when road construction started. The Board's opinion is consistent with the placement of a sump below the spring to collect water for firefighting. The Board believes that there was a significant amount of water flowing from the spring prior to the road failure, rather than just dampness, and that the spring was detectible. The licensee was subsequently aware of dampness in the area, but did not plan for the significant water flowing from the spring prior to the failure.

Therefore, the only site factor causing instability that was foreseeable but not planned for was the water flowing from the spring. The Board considered whether the spring's flow was likely to create conditions that could result in a landslide. Would a qualified and experienced practitioner expect that water flowing across the upper fire access trail was likely to create conditions that could result in road building triggering a landslide?

Road construction activities can affect both surface and groundwater flows. The geotechnical report stated that the impact of blasting on groundwater flows in bedrock has long been known. In the Board's view, it was reasonable to expect that blasting could increase water flowing from the spring. The terrain stability field assessment concluded with the terrain assessor's expectation that "some extraordinary techniques will be employed during construction to investigate site specific terrain attributes such as rock competence and unforeseen drainage occurrences." Based on that information, the Board believes that water flowing in the vicinity of the road prism and fire access trail, in an area identified as having potentially unstable terrain, could create conditions that were likely to result in road building causing a landslide. The licensee should, therefore, reasonably have known that road building may result in a landslide and further investigated the immediate area, especially given the licensee's intent to build an engineered structure on top of the fire access trail.

The licensee re-established a diverted creek back to its natural course and placed material to ensure that the water from the spring flowed over the upper fire access trail. However, that water flow from the spring was not reassessed by the licensee or its hired professionals during road construction or otherwise acted upon. In the Board's view, the licensee's actions were inadequate to address the likelihood that the water flow created conditions that could result in

road building causing a landslide. The licensee therefore failed to comply with section 45(3) in regard to landslide 1.

The district manager found that the licensee, its contractors and its hired professionals should have suspected that the fire access trail downslope of the road might not be structurally sound. The review panel found that the use of the fire trial to facilitate road construction combined with the history of the area, a diverted water source and potentially unstable soils, combined with high downstream resource values, were all strong indicators that a proper assessment was needed downslope of the road construction right-of-way. The Board did not find that the fire access trail contributed to instability. However, the Board agrees that one detectible site factor (the spring) should have caused the licensee to recognize that road construction may result in a landslide.

Landslide 2

Participants generally agree that the area where landslide 2 occurred was destabilized by the following, previously unidentified site factors:

- saturated soil at the base of the stacked rock fill;
- seepage in the bedrock; and
- a weak bedrock layer of talc schist and soapstone.

The Board considered whether those site factors were detectable or foreseeable. Considerations included that road building commonly affects both ground water and subsurface water flows. The licensee could have been alerted to the potentially unstable bedrock by landslide 1, which previously exposed the weak rock formation. The terrain stability field assessment noted that the Schroeder Creek watershed includes areas of potentially unstable formations, including a slide chute with unstable geology 40 metres past where the slide occurred. Finally, the road builder also exposed a small portion of the talc schist when constructing the roadside ditch after the stacked rock fill was built.

However, the talc schist was generally below the construction grade and was not exposed until road building was near completion. Prior to that, there were no indications of unstable bedrock within the specific area where landslide 2 occurred. The terrain assessor, professional engineer and road building contractors also found no indicators of wet soil conditions or seepage during the terrain assessment and road building. On balance, the Board finds that there was insufficient evidence to conclude that the wet conditions or the extent of the talc schist were detectible or foreseeable. As section 45(3) relates to only detectible site factors, the failure to identify and address those site factors does not support a finding of non-compliance with section 45(3). The licensee therefore complied with section 45(3) in regard to landslide 2.

3. Was enforcement of the Code appropriate?

The complainant believes that the district manager failed to identify contraventions of the Code and did not take appropriate action in response to those contraventions. The complainant believes that the district manager should have issued a stop work order in response to the landslides, and should have imposed a penalty for contraventions associated with landslide 1.

The purpose of enforcement is to promote compliance with the Code. Enforcement activities generally begin with monitoring and inspections. These should be done at a frequency that is appropriate for the risk to forest resources. If problems are discovered, the ministry has a number of tools available to promote compliance. These tools escalate in severity and include written instructions, stop work orders, administrative penalties, prosecution and licence cancellation. The Board therefore addressed the complaint issues by considering:

- Was enforcement effective at detecting Code infractions?
- Was an appropriate range of enforcement actions used to encourage compliance?

The ministry's enforcement actions detected two Code infractions. One was that the licensee had failed to remove two logs from the roadbed in the area of landslide 2, contrary to the Code. The other was that the district manager determined that the licensee should have reasonably known that road building may result in landslide 1, thereby contravening the Code. The Board found no evidence that the ministry failed to identify any Code infractions for the area of landslide 1 or 2. The ministry's enforcement actions were therefore effective at detecting Code infractions.

The district manager's enforcement actions did not include issuing a stop work order. A district manager has discretion to issue a stop work order under section 123 of the Act. However, that action is best suited to ongoing contraventions, which did not apply here.

The district manager did not levy a penalty for the contravention associated with landslide 1 because he found that the impact to the environment was likely low. He stated that a deterrent penalty would not be appropriate because the licensee had been diligent in following its road layout and design and had relied on the advice of professionals. He considered that decision relative to section 117 of the Act, which sets out optional considerations for determining the amount of a penalty including:

- the gravity and magnitude of the contravention;
- previous contraventions of a similar nature;
- whether the violation was repeated, continuous, or deliberate;
- any economic benefit derived by the person from the contravention; and
- the licensee's cooperativeness and efforts to correct the contravention.

The Board believes that a contravention that could compromise drinking water quality is a serious matter. However, local residents were pleased with the licensee's response to the landslide. This was the first landslide on the Schroeder Creek road. There were no similar previous contraventions of section 45(3) by the licensee. The licensee did not derive any economic benefit, and had incurred remediation costs of about $15,000. Given those considerations, the Board agrees with the district manager's decision to not levy a penalty for landslide 1.

Although the district manager decided not to issue a penalty, the ministry did carry out inspections and investigations, and make a determination. The ministry determined that the road presented a very high risk to the environment, requiring a total of six inspections. After the landslides occurred, the frequency of inspections was further increased. District staff investigated both landslides in detail, and the district manager made a determination for landslide 1. The ministry warned the licensee about the logs in the road, and followed up to ensure that the licensee had remediated landslide 1 and 2. Under the circumstances, the Board considers that the range of enforcement actions was appropriate for encouraging compliance with the Code.

In summary, the Board finds that the ministry was effective at detecting contraventions and used an appropriate range of enforcement actions to encourage compliance. Therefore, the ministry's enforcement of the Code was appropriate.

Conclusions

The terrain stability field assessment was not adequate for the challenging terrain conditions of the Schroeder Creek watershed because it did not provide all of the information recommended by the guidebook, nor an explanation for why it did not include all of the recommended information.

The licensee's planning and road building in the area of landslide 1 and landslide 2 complied with the Code, with two exceptions. The licensee failed to remove all organic material from the roadbed for the area of landslide 2. That non-compliance was not significant, given the small amount of organic material involved. However, the licensee should have reasonably known that the observable water flowing from the spring prior to landslide 1 was likely to create conditions that could result in road building causing a landslide. By not investigating the water flow in greater detail after it was discovered, the licensee did not comply with section 45(3) of the Act.

Commentary

Some of the legislative requirements in this investigation may no longer apply under the *Forest and Range Practices Act*. For example, the Board understands that a licensee will not usually be required to submit road designs or modifications for approval, complete terrain stability field assessments or hire qualified registered professionals. A licensee will have flexibility and responsibility for deciding who to consult and what assessments to complete. That change will shift responsibility and accountability for ensuring sound, sustainable forest management from government to licensees. A licensee must ensure that the standard of care applied is appropriate for the conditions encountered, particularly if it wishes to demonstrate due diligence as a defence against potential contraventions of the *Forest and Range Practices Act*.

The Board notes that, in support of sound forest practices, professional associations will need to clearly define the responsibilities of their members when conducting assessments. This includes ensuring their members, when preparing assessments, follow best management practices or provide a rationale for not doing so, particularly when operating in challenging terrain. The Board is aware that the Association of Professional Engineers and Geoscientists has recently provided such guidance to its members, specifically for terrain stability field assessments, and encourages this type of support for professionals.

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